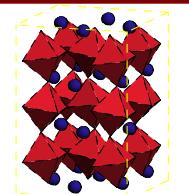


Tuning The Magnetic and Electronic Properties of Perovskite Manganites

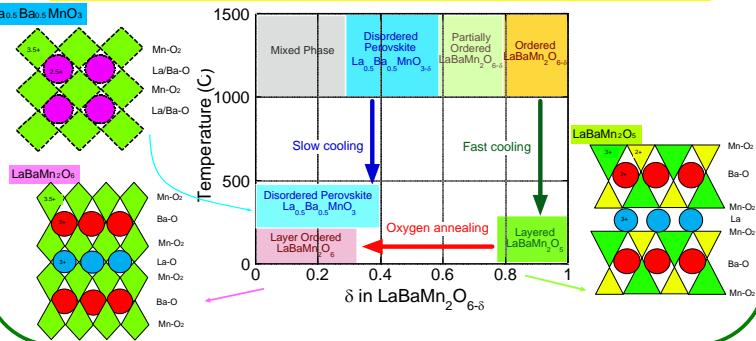
O. Chmaissem, B. Dabrowski, Northern Illinois University and Argonne National Laboratory
 J. D. Jorgensen, S. Short, Argonne National Laboratory; J. Mais, S. Kolesnik, Northern Illinois University

Motivation: Perovskite manganites (ABO_3 -type) display a broad range of magnetic, electronic, and ionic conductivity behavior depending on the chemical composition and crystal structure. However, many of these manganite systems reach their limits just when the materials are about to become even more interesting and useful in advanced applications. As such, we have systematically developed new synthesis techniques that can considerably extend the solubility limits to achieve better materials and derive new phase diagrams. With these methods, we can now tune the material's properties by the selective ordering or disordering of metal atoms on the A or B sites.

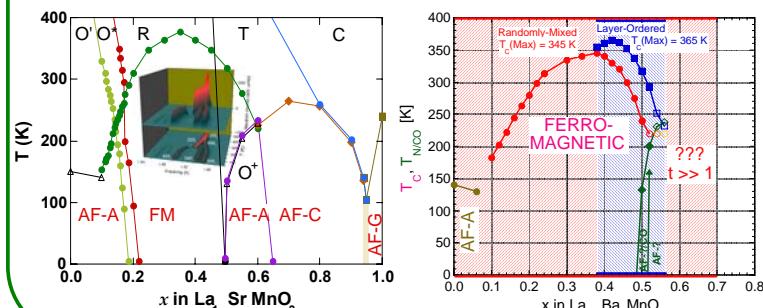


Crystal Structure of ABO_3

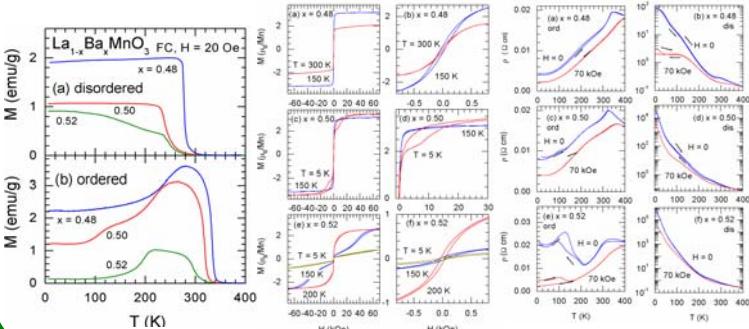
Control of Chemical Ordering/Disordering and Oxygen Stoichiometry



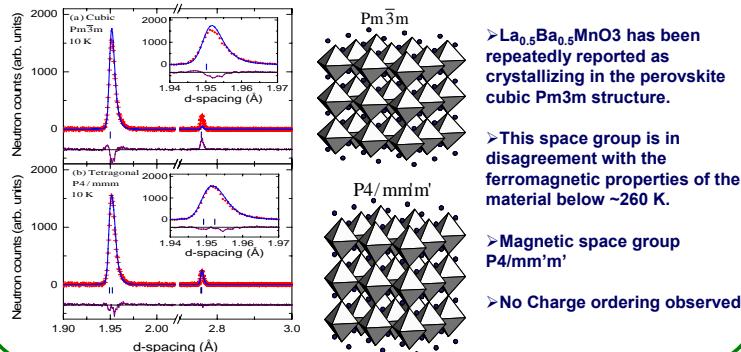
Phase Diagrams of Previously Inaccessible Chemical Compositions and Systems



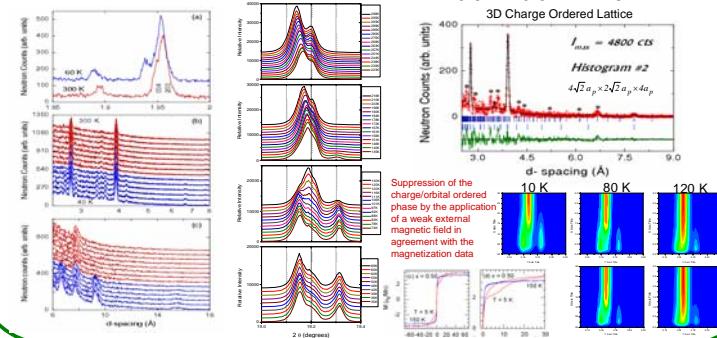
Properties of Ordered/Disordered $\text{La}_{1-x}\text{Ba}_x\text{MnO}_3$



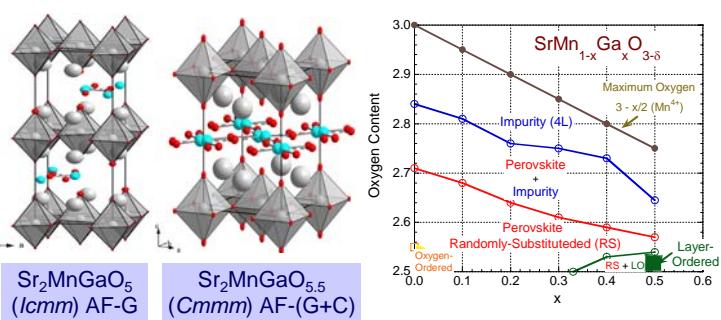
Disordered $\text{La}_{0.5}\text{Ba}_{0.5}\text{MnO}_3$ Structures



Charge, Orbital Ordering and Phase Separation in Ordered $\text{La}_{0.5}\text{Ba}_{0.5}\text{MnO}_3$

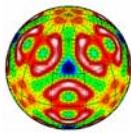


Properties of B-site randomly-mixed and layer-ordered perovskites $\text{SrMn}_{1-x}\text{Ga}_x\text{O}_{3-\delta}$



Impact: Our rules for the synthesis of perovskites enable the design of complex compositions and crystal structures of these materials to be controlled in order to achieve the desired physical and chemical properties for applications.

- Tolerance Factor Rules for $\text{Sr}_{1-x-y}\text{Ca}_x\text{Ba}_y\text{MnO}_3$ Perovskites. B. Dabrowski et al., J. Solid State Chem. 170, 154 (2003)
- Effects of A-site ordering on the structures and properties of $\text{La}_{1-x}\text{Ba}_x\text{MnO}_3$ ($x \sim 0.5$). O. Chmaissem et al., Phys. Rev. B 72, 104426 (2005)
- Structural and magnetic phase diagrams of $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$ and $\text{Pr}_{1-y}\text{Sr}_y\text{MnO}_3$. O. Chmaissem et al., Phys. Rev. B 67, 094431 (2003)



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MSD - ANL

